

10.—NEW SPECIES OF CHITONS FROM BROOME, WESTERN AUSTRALIA.

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(A contribution in part from the South Australian Museum.)

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INTRODUCTION.

Dr. William J. Clench, Curator of Molluscs of the Museum of Comparative Zoology at Harvard College, Mass., U.S.A., sent to one of us all the Polyplacophora collected by Mr. H. L. Clark on the last Australian Expedition sent out by that Museum, together with some collected previously. Thanks are due to Dr. Clench for giving us the opportunity to examine these specimens from an area so little worked, and for the donation of four specimens to the Ashby Collection in the South Australian Museum. Amongst those taken at Gantheaume Point, Broome, are four new species described hereafter. Of those taken, only three examples belong to the somewhat restricted genus *Callistochiton* and it is astonishing to find that they represent three distinct and new species.

Discussion on the retention of the name Callistochiton.

The genus *Callistochiton* is defined by Pilsbry (Man. Con. Vol. 14, p. 260) and diagnosed by the peculiar character of the insertion plates which are "festooned, being curved outward at the ribs and slit there, thickened outside at the edges of the slits, the latter corresponding in position to the ribs of the outer surface." The genus *Lophochiton* Ashby, has the insertion plates similar to an *Ischnochiton* without any festooning at the slits. Hull overlooked this important feature and placed *Lophochiton granifer* Hull under the genus *Callistochiton* on its external characters only. Iredale and Hull propose to separate the Australian *Callistochiton* from the American and introduce for the Australian group a new genus *Callistelasma*. We consider that their definition does supply adequate data for such generic separation and we are awaiting the receipt of specimens of the type species of Dall's genus *Callistochiton*, when we hope critically to study and compare the two groups.

Callistochiton broomensis, sp. nov.

Pl. XIII, fig. 3.

General appearance. (Dry example).—Oblong, elongate, valves 2 to 7 equal width, medium elevation, arched not carinate, end valves and lateral areas decussated with conical nodules, spaced and arranged in riblets. Colour avellaneous (Ridg. XL.). Girdle broad, clothed with minute scales.

Head valve.—Decorated with ten complete and eight intercalated conically nodulose riblets, the ten riblets continued to the apex, anterior slope curved but steeper at the apex. Interstices minutely subgranulose.

Median valve.—Arched, not carinated, dorsal area covered with a net-work sculpture; pleural area, with about nine longitudinal rows of coarse, spaced conical grains, the interstices the same width as the grains, and if granulose at all, subgranulose; lateral area is deeply grooved down the centre almost from the jugum (or dorsal ridge) with a double row of spaced grains on either side. On the posterior margin the nodules are broad and spade shape, not conical.

Tail valve.—Mucro defined, central, posterior portion rather flat, radial rows similar to anterior valve 19; anterior portion decorated similar to the pleural areas except the grains are smaller.

Girdle.—(Dry) .2mm. wide and a little less in front of head valve; densely clothed with non-striate scales which are set erectly, closely packed, exposed portion minute and slightly bent over.

Measurements.—Shell curled and bent, not disarticulated, estimated 20mm. x 10mm. of which the exposed shell occupies one half only.

Holotype in Ashby Collection, Reg. No. D.1073. S.A. Museum.

Habitat.—Gantheaume Point, Broome, W.A. (Coll. U.S.A. Exped.)

Callistochiton clenchi, sp. nov.

Pl. XIII., fig. 1.

General appearance. (Dry example).—Oblong, not straight sides as in *C. broomensis* but greatest width reached on valves four and five; subcarinate, side slope curved, elevation medium; end valves and lateral areas ornamented with nodulose ribs; pleural areas with highly raised, very narrow granulose longitudinal ribs, no bridging; net-work sculpture confined to dorsal area. Colour wood brown (Ridg. XL.).

Head valve.—Decorated with fourteen complete (often bifurcating) riblets, which are coarsely nodulose (about twelve nodules in each rib), and continued to the apex; anterior slope straight.

Median valve.—Dorsal area slightly beaked, covered posteriorly with net-work sculpture which in some cases changes into low ribbing anteriorly, interstices minutely granulose; pleural area, ten to eleven very narrow highly raised, beaded, granulose longitudinal ribs which are parallel except at the junction with the lateral where they turn upwards slightly, the interstices occupied by transverse rows of very minute granules that are consistently regular, there is no bridging sculpture; lateral area deeply grooved from the jugum to the outer margin in the centre, with a highly raised, coarsely nodulose rib, mostly bifurcating on either side.

Tail valve.—Mucro defined, subanti-central, posterior slope concave, with fifteen (sometimes bifurcating) nodulose ray ribs, anterior portion similar to dorsal and pleural areas of median valves, except that the transition from dorsal sculpture to pleural is somewhat confused.

Girdle. (Dry).— $2\frac{1}{2}$ mm. wide, less in front of head valve; densely clothed with non-striate, fairly large imbricating scales, the exposed portions much larger than in *C. broomensis*.

Measurements.—Shell curled, not disarticulated, estimated 19mm. x 12mm., of which the exposed portion of shell occupies 7mm.

Holotype in Ashby Collection, Reg. No. D.10724, S.A. Museum.

Habitat.—Gantheaume Point, Broome, W.A. (Coll. U.S.A. Exped.)

Callistochiton occiduus, sp. nov.

Pl. XIII., fig. 4.

General appearance.—(Dry example) not disarticulated. Oblong, the four central valves of equal width, subcarinate, side slope curved, elevation medium; end valve and lateral areas decorated with strongly raised ribs which are surmounted with widely spaced, shallow, mostly pyramidal nodules; the pleural areas possess coarse, somewhat bent, longitudinal ribbing which is mostly non-granulose, there is no network sculpture or bridging in this area; the girdle is broad and clothed with closely packed somewhat irregular non-striate scales and is distinctly banded. Colour avellaneous mottled with wood brown (Ridgeway), the darker marking forming three bands, a narrow one down dorsal ridge and a broad one on each side.

Head valve.—Slope slightly curved, radial ribs thirteen, highly raised and without bifurcation, surmounted by widely spaced pyramidal nodules, the ribs are not carried to the apex, the interspaces are irregularly, minutely granulose.

Median valve.—Dorsal area with irregular net-work sculpture which changes to longitudinal riblets anteriorly; pleural area decorated with shallow narrow longitudinal riblets which are not parallel with one another but in places much bent and having mostly a sharp upward bend where they join the lateral area; interstices sometimes wide, in others narrow and the surface minutely granulose sometimes transversely arranged but quite irregular in other parts; the longitudinal ribs are often smooth on the ridge, in others showing shallow granules, but very distinct from the straight beaded ribs of *C. clenchi*; lateral areas deeply grooved in the region from jugum to girdle, with one strongly raised nodulose rib on either side, the posterior rib of these pairs just commencing to bifurcate, the nodules are very widely spaced and more or less pyramidal in form, the interspaces similar to those of the pleural area.

Tail valve.—Mucro well defined, anticephalic, posterior slope straight and flat, the ray sculpture consisting of separated coarse conical grains, the anterior portion sculptured similar to the pleural areas.

Girdle.—Girdle scales of different sizes, irregularly mixed small and large fairly equally divided, whitish, opaque and at certain angles showing polish, irregularly imbricating, not striate.

Measurements.—Shell dry, somewhat curved and not disarticulated, 22mm. x 10mm. of which the girdle occupies nearly 4mm., less anteriorly; exposed section of shell 7mm.

Holotype in Ashby Collection, Reg. No. D.10725, S.A. Museum.

Habitat.—Gantheaume Point, Broome, W.A. (Coll. U.S.A. Exped.)

Comparisons.

C. broomensis is easily distinguished from any other known Australian *Callistochiton* by the large pointed grains of its sculpture and entire absence of bridging.

C. clenchi by the highly raised parallel longitudinal ribs of the pleural area which are surmounted with the appearance of a string of tiny beads or circular grains, and in the entire absence of bridging.

C. occiduus, from *clenchi* by the widely spaced nodulose sculpture of the lateral area, and the bent, irregular character of the longitudinal ribbing of the pleural area.

Callistochiton meridionalis, *antiquus* and *periousia* are easily separated from the three new species by their girdle scales, which are minute, and by the extensive bridging occurring in the pleural area. The same distinction holds good with *C. mawlei*. The minute granulose sculpture in the inter-spaces between the ribs in all the three Broome species is not to be compared with the characteristic "bridging" of most *Callistochitons*.

Callistochiton generos, in its peculiar large-mesh net-work sculpture and in its possessing large, thin, imbricating, highly striate scales, is distinct from the three new species or any other known Australian form.

***Ischnochiton (Haploplax) bromensis*, sp. nov.**

Pl. XIII., fig. 2.

There are two specimens from Broome which prove to be a new and very distinct form, belonging to the subgenus *Haploplax* of the genus *Ischnochiton*.

General appearance.—The larger—selected as holotype—dry, measures 15mm. x 9.5mm. and the smaller 13mm. x 8mm., flat, but slightly carinate, dorsal and pleural areas uniformly, and for the genus, coarsely decussate, the two end valves coarsely, evenly granulose, grains inconspicuously arranged in radial rows, the lateral areas sculptured with sharply cut, broken radial ribs, a somewhat unique feature for any known Australian representatives of the genus *Haploplax*. The holotype has a creamy-white, blushed with pink, dorsal band commencing at the girdle on the head valve and widening posteriorly to almost include the whole of the tail valve except for a terminal darker V-shaped mark; two bluish-gray bands adjoining the girdle on the median valves; the paratype has a U-shaped white mark on the head valve, the rest of this valve dark; dorsal areas of valves two and five, dark; valve six all dark; seven and tail valve creamy-white. In both shells there is pale mottling over the lighter markings. It is evident that in colour markings this species will be as variable and decorative in colour markings as its near ally, *I. (H) smaragdinus* Angas.

Head valve.—Large and shallow, anterior slope straight, except close to the girdle, where the angle of slope is slightly altered upward; whole shell decorated with irregular, pebble-shaped grains, under lateral lighting shown to be arranged in much broken, irregular, radial riblets numbering roughly about forty.

Median valve.—Dorsal and pleural areas inseparable, decorated with decussated sculpture, much coarser than usual in this subgenus; lateral area with much broken, deeply cut radial ribs numbering six or seven, the interstices irregularly covered with granules tending to obscure the radial ribs which need lateral lighting for observation.

Tail valve.—Elevation exceptionally shallow, mucro well defined, posterior slope concave and decorated similar to the head valve; anterior portion forms about one-third of the valve and has similar decoration to the pleural areas of the median valves.

Inside.—The gills extend from the head to about three-quarters the length of the foot.

Articulamentum.—Whitish with wash of pink at jugum and of blue laterally.

Slits.—Head valve 10, median valves 1/1, tail valve 12; sutural laminae shallow, sinus between broad.

Girdle.—Evenly banded throughout and clothed with polished, pebble-like scales without striae.

Measurements of Holotype.—Whole shell (dry) 15 x 9.5 mm., head valve 2.4 x 5.7 mm., median valves 2.5 x 7 mm., tail valve 3.2 x 6 mm.

Habitat.—Grantheaume Point, Broome, W.A. (Coll. U.S.A. Exped.)

Comparisons.—The coarse sculpture readily distinguishes it from any other *Haploplax*. *Ischnochiton arbutum* Reeve approaches it, but the form of that species from Palm Island, Queensland, merely shows a little radial subobselete ribbing in the lateral areas, broad in proportion to length being almost circular shells. Examples of *I. arbutum* from Cape Yorke (compared with the types in London) are more elevated and have coarser sculpture, but differ from the species under review, not only in their greater elevation, but also the ribs in the lateral area are much less defined and deeply cut. The tail valve in *broomensis* is larger, flatter, and the mucro more posterior than in the case of *arbutum*, the posterior slope is straight and steep in the north coast *arbutum* whereas in *broomensis* it is concave and flat and the anti-mucronal portion much larger.

Iredale and Hull publish a M.S. name of Carpenter's *Lepidopleurus cygneus*, for a single example in the British Museum said to have come from N.W. Australia. The only definition supplied is that the sculpture is less strong than in *I. (H) Arbutum*. As the species under review is shown to have definitely stronger sculpture than *arbutum* we have no grounds for considering it conspecific with *L. Cygneus*.

Isochiton sub. gen. nov.

Girdle scales, canoe or shuttle-shape similar to the genus *Callochiton*, but insertion plates *Ischnoid*; slits in median valves 1/1 sometimes 2. Sculpture, closely packed radial riblets in end valves and lateral areas; pleural areas longitudinally ribbed, slits do not correspond with the ribs in the anterior valve as in *Callistochiton*. Until it is possible to examine the characters of the body and radula this genus may be regarded provisionally as intermediate between the genera *Ischnochiton* and *Callochiton*, but accurate conclusions are impossible from the somewhat imperfect specimens before us. It may be regarded as a subgenus of *Ischnochiton*. Type *Isochiton bardwelli* sp. nov., described below.

Ischnochiton (Isochiton) bardwelli sp. nov. Pl. Fig. 5.

Capt. Beresford Bardwell sent three damaged examples of a new species from Broome. They were labelled *Solvaga recens* Thiele but are quite distinct from that species in sculpture, insertion plates and girdle scales. We have pleasure in naming it after the donor.

General appearance.—Carinated, oval; third and fourth valve broadest laterally, tapering from there posteriorly; end valves and lateral areas decorated with closely packed ray-ribs; jugum, smooth; rest of dorsal areas and pleural areas possess well defined, straight, longitudinal ribs. Colour; anterior valve, dorsal area of median valves and centre of tail valve creamy white, rest of shell dark brown. Both paratypes are cream colour with pale banding on girdle.

Head valve.—Strongly raised, anterior slope steep, concave, decorated with about fifty radiating ribs of varying length, the elevated apex smooth.

Median valve.—Jugum, narrowly wedge-shape and smooth, rest of the dorsal area longitudinally ribbed; pleural area decorated with longitudinal

ribs which are straight, including those in the dorsal area, eight in number; those in the dorsal area half the width of the rest; these ribs are not strictly granulose but closely grooved at right angles to their length; lateral areas possess radiating ribs of varying length grooved transversely with growth lines which increase in number posteriorly until in the post mucronal area of the tail valve the ribs become granulose.

Tail valve.—Mucro anterior, posterior portion of valve straight with a very slight slope and decorated with about fifty radiating granulose ribs; the portion immediately under the mucro steeper and under 20 X magnification rugose; anterior mucronal area is similar to the dorsal and pleural areas of the median valves.

Inside. (Articulamentum).—Head valve fourteen slits, irregular, teeth smooth; *median valves* 1/1 slits, valve four an additional slit on one side; tail valve eleven slits; eaves apparently not spongy, teeth not propped.

Girdle.—Clothed with elongate canoe or shuttle-shaped scales (similar to those in the genus *Callochiton*) but are not imbricating as in that genus, but are mostly exposed for the whole length, commencing parallel to the shell but rapidly changing to a position at right angles to the shell; this arrangement gives an irregular curved disposition of the scales; scales themselves, smooth and polished. This peculiar arrangement of the scales is easily seen under a 65 X magnification, but is not easily distinguished with the ordinary pocket lens. The girdle is 1.5mm. in width.

Measurement.—Holotype, whole shell, 11.5mm. x 7mm. (girdle partly missing so should measure a little more). Paratype No. 1, 13.5mm. x 9mm., No. 2, 11mm. x 7.5mm., head valve 5mm. x 2.75mm., median valve (fourth valve) 5.5mm. x 2.5mm., tail valve 4mm. x 2.5mm. The sutural laminae are only undamaged in the tail valve and these are shallow, anterior edge straight, sinus rather broad. Articulamentum white, tegmentum turned over under the umbo, does not appear sculptured.

Habitat.—Dredged off Broome in about 7 fathoms.

Comparisons.—Girdle scales similar to those of *Callochiton mayi*, but the arrangement is different. In *Callochiton* the scales vary from needle-shape to shuttle-shape and are placed at right angles to the longitudinal line of the shell, but in the present species they commence horizontal to the shell then rapidly, somewhat irregularly assume a right angle direction and do not imbricate as in *Callochiton*.

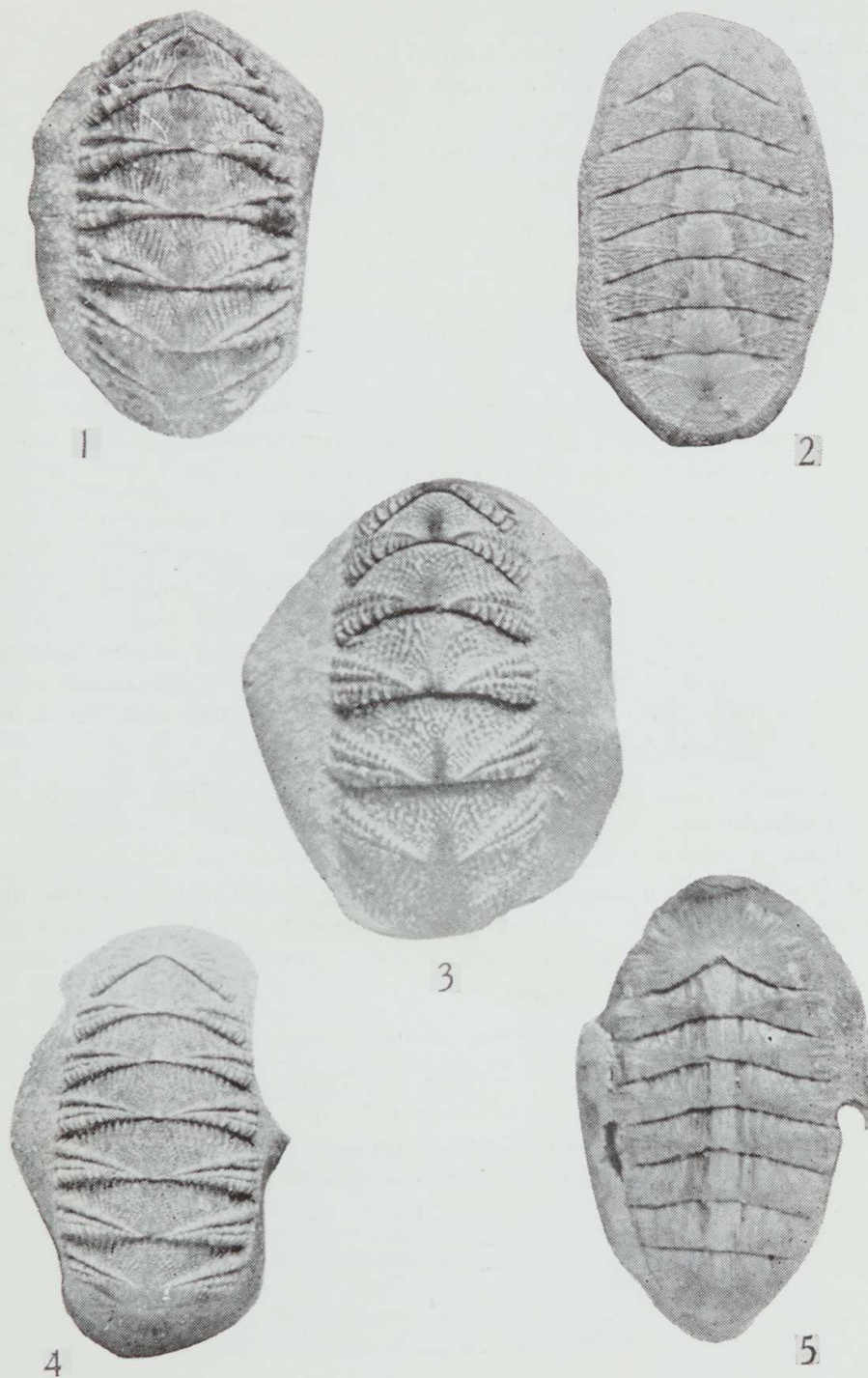


PLATE XIII.

EXPLANATION OF PLATE.

- Fig. 1.—*Callistochiton clenchi* sp. nov.
 Fig. 2.—*Ischnochiton broomensis* sp. nov.
 Fig. 3.—*Callistochiton broomensis* sp. nov.
 Fig. 4.—*Callistochiton occiduus* sp. nov.
 Fig. 5.—*Ischnochiton bardwelli* sp. nov.